AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently amended) A method for communicating between a first semiconductor die and a second semiconductor die through optical signaling, comprising:

converting an electrical signal into an optical signal using an electrical-to-optical transducer located on a face of the first semiconductor die;

passing the optical signal through an interposer sandwiched between the first semiconductor die and the second semiconductor die, wherein the interposer contains a plurality of waveguides that direct the optical signal, so that the optical signal shines on the second semiconductor die, and wherein the plurality of waveguides have a pitch less than 50 microns;

wherein the first semiconductor die and the second semiconductor die are oriented face-to-face so that the optical signal generated on the first semiconductor die shines on the second semiconductor die;

receiving the optical signal on a face of the second semiconductor die; and

converting the optical signal into a corresponding electrical signal using an optical-to-electrical transducer located on the face of the second semiconductor die.

2. (Original) The method of claim 1, wherein after generating the optical signal on the first semiconductor die, the method further comprises passing the

optical signal through annuli located within metal layers on the first semiconductor die to focus the optical signal onto the second semiconductor die.

3. (Original) The method of claim 1, wherein after generating the optical signal on the first semiconductor die, the method further comprises using a lens to focus the optical signal onto the second semiconductor die.

4. (Original) The method of claim 1, wherein after generating the optical signal on the first semiconductor die, the method further comprises using a mirror to reflect the optical signal, so that the optical signal can shine on the second semiconductor die without the first semiconductor die having to be coplanar with the second semiconductor die.

5 (Canceled).

6. (Original) The method of claim 1,

wherein the electrical-to-optical transducer is a member of a plurality of electrical-to-optical transducers located on the first semiconductor die; and

wherein the optical-to-electrical transducer is a member of a plurality of optical-to-electrical transducers located on the first semiconductor die;

whereby a plurality of optical signals can be transmitted in parallel from the first semiconductor die to the second semiconductor die.

7. (Original) The method of claim 6,

wherein multiple spatially adjacent electrical-to-optical transducers in the plurality of electrical-to-optical transducers transmit the same signal; and

wherein electronic steering circuits in the first semiconductor die direct data to the multiple spatially adjacent electrical-to-optical transducers to correct mechanical misalignment in X, Y and Θ coordinates.

8. (Original) The method of claim 6,

wherein multiple spatially adjacent optical-to-electrical transducers in the plurality of optical-to-electrical transducers receive the same signal; and

wherein electronic steering circuits in the second semiconductor die direct data from the multiple spatially adjacent optical-to-electrical transducers to correct mechanical misalignment in X, Y and Θ coordinates.

9. (Original) The method of claim 1, wherein the electrical-to-optical transducer includes one of:

a Zener diode;

a light emitting diode (LED);

a vertical cavity surface emitting laser (VCSEL); and

an avalanche breakdown P-N diode.

10. (Original) The method of claim 1, wherein the optical-to-optical transducer includes one of:

a P-N-diode photo-detector; and

a P-I-N-diode photo-detector.

11. (Currently amended) An apparatus for communicating between semiconductor chips through optical signaling, comprising:

a first semiconductor die;

a second semiconductor die;

an electrical-to-optical transducer located on a face of the first semiconductor die, which is configured to convert an electrical signal into an optical signal;

wherein the first semiconductor die and the second semiconductor die are oriented face-to-face so that the optical signal generated on the first semiconductor die shines on the second semiconductor die;

an optical-to-electrical transducer located on a face of the second semiconductor die, which is configured to convert the optical signal received from the first semiconductor die into a corresponding electrical signal; and

an interposer sandwiched between the first semiconductor die and the second semiconductor die, wherein the interposer contains a plurality of waveguides that direct the optical signal, so that the optical signal shines on the second semiconductor die, and wherein the plurality of waveguides have a pitch less than 50 microns.

12. (Original) The apparatus of claim 11, further comprising annuli located within metal layers on the first semiconductor die configured to focus the optical signal onto the second semiconductor die.

13. (Original) The apparatus of claim 11, further comprising a lens configured to focus the optical signal onto the second semiconductor die.

14. (Original) The apparatus of claim 11, further comprising a mirror configured to reflect the optical signal, so that the optical signal can shine on the second semiconductor die without the first semiconductor die having to be coplanar with the second semiconductor die.

15 (Canceled).

16. (Original) The apparatus of claim 11,

wherein the electrical-to-optical transducer is a member of a plurality of electrical-to-optical transducers located on the first semiconductor die; and

wherein the optical-to-electrical transducer is a member of a plurality of optical-to-electrical transducers located on the first semiconductor die;

whereby a plurality of optical signals can be transmitted in parallel from the first semiconductor die to the second semiconductor die.

17. (Original) The apparatus of claim 16,

wherein multiple spatially adjacent electrical-to-optical transducers in the plurality of electrical-to-optical transducers transmit the same signal; and

wherein electronic steering circuits in the first semiconductor die direct data to the multiple spatially adjacent electrical-to-optical transducers to correct mechanical misalignment in X, Y and Θ coordinates.

18. (Original) The apparatus of claim 16,

wherein multiple spatially adjacent optical-to-electrical transducers in the plurality of optical-to-electrical transducers receive the same signal; and

wherein electronic steering circuits in the second semiconductor die direct data from the multiple spatially adjacent optical-to-electrical transducers to correct mechanical misalignment in X, Y and Θ coordinates.

19. (Original) The apparatus of claim 11, wherein the electrical-to-optical transducer includes one of:

a Zener diode;

a light emitting diode (LED);

a vertical cavity surface emitting laser (VCSEL); and

an avalanche breakdown P-N diode.

20. (Original) The apparatus of claim 11, wherein the optical-to-optical transducer includes one of:

a P-N-diode photo-detector; and

a P-I-N-diode photo-detector.

21. (Currently amended) A computer system including semiconductor chips that communicate with each other through optical signaling, comprising:

a first semiconductor die containing one or more processors;

a second semiconductor die containing circuitry that communicates with the one or more processors;

an electrical-to-optical transducer located on a face of the first semiconductor die, which is configured to convert an electrical signal into an optical signal;

wherein the first semiconductor die and the second semiconductor die are oriented face-to-face so that the optical signal generated on the first semiconductor die shines on the second semiconductor die;

an optical-to-electrical transducer located on a face of the second semiconductor die, which is configured to convert the optical signal received from the first semiconductor die into a corresponding electrical signal; and

an interposer sandwiched between the first semiconductor die and the second semiconductor die, wherein the interposer contains a plurality of waveguides that direct the optical signal, so that the optical signal shines on the second semiconductor die, and wherein the plurality of waveguides have a pitch less than 50 microns.

22. (Original) The computer system of claim 21, further comprising annuli located within metal layers on the first semiconductor die configured to focus the optical signal onto the second semiconductor die.

23. (Original) The computer system of claim 21, further comprising a lens configured to focus the optical signal onto the second semiconductor die.

24. (Original) The computer system of claim 21, further comprising a mirror configured to reflect the optical signal, so that the optical signal can shine on the second semiconductor die without the first semiconductor die having to be coplanar with the second semiconductor die.

25 (Canceled).

26. (Original) The computer system of claim 21,

wherein the electrical-to-optical transducer is a member of a plurality of electrical-to-optical transducers located on the first semiconductor die; and

wherein the optical-to-electrical transducer is a member of a plurality of optical-to-electrical transducers located on the first semiconductor die;

whereby a plurality of optical signals can be transmitted in parallel from the first semiconductor die to the second semiconductor die.

27. (Original) The computer system of claim 26,

wherein multiple spatially adjacent electrical-to-optical transducers in the plurality of electrical-to-optical transducers transmit the same signal; and

wherein electronic steering circuits in the first semiconductor die direct data to the multiple spatially adjacent electrical-to-optical transducers to correct mechanical misalignment in X, Y and Θ coordinates.

28. (Original) The computer system of claim 26,

wherein multiple spatially adjacent optical-to-electrical transducers in the plurality of optical-to-electrical transducers receive the same signal; and

wherein electronic steering circuits in the second semiconductor die direct data from the multiple spatially adjacent optical-to-electrical transducers to correct mechanical misalignment in X, Y and Θ coordinates.

29. (Original) The computer system of claim 21, wherein the electrical-to-optical transducer includes one of:

a Zener diode;

a light emitting diode (LED);

a vertical cavity surface emitting laser (VCSEL); and

an avalanche breakdown P-N diode.

30. (Original) The computer system of claim 21, wherein the optical-to-optical transducer includes one of:

a P-N-diode photo-detector; and

a P-I-N-diode photo-detector.